

CLAIMS

What is claimed is:

1. A high temperature gas flow sensing element module for use within a fluid conduit, said flow sensing element module comprising:

a housing having an inlet, an outlet, and forming a hollow interior cross sectional area;

a total pressure sensing Pitot tube array affixed within said housing traversing the interior cross sectional area of said flow element module for sensing the total pressure of fluid flowing into said flow element module;

a static pressure sensing Pitot tube affixed within said housing and traversing the interior cross sectional area of said flow element module for sensing the static pressure within said flow element module; and

exterior instrument taps for connection of each array respectively to a differential pressure instrument for indicating flow rate and/or transmitting a flow rate signal.

2. The high temperature gas flow sensing element module as described in Claim 1, wherein said a total pressure sensing Pitot tube array comprises:

a total pressure manifold;

a plurality of linearly elongated Pitot tubes having a first end and a second end in fluid communication with and anchored at said second end to said total pressure manifold;

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a plurality of sensing ports penetrating each said Pitot tube and directed to face directly toward said inlet, thereby providing free fluid communication between the impacting fluid flowing into said flow element module through the Pitot tube and said total pressure manifold; and

5 a high-temperature tubing connection for affixing said first end of each said Pitot tube to said housing, said high temperature tubing connection comprising a compression fitting.

10 3. The high temperature gas flow sensing element module as described in Claim 1, wherein said a static pressure sensing Pitot tube comprises:

15 a linearly elongated pressure sensing tube having a first end and a second end in fluid communication with and anchored at said second end to said housing; a plurality of sensing ports penetrating each said pressure sensing tube and directed to face perpendicular to the flow path across said gas flow sensing element;

a high-temperature tubing connection for affixing said first end of each said Pitot tube to said housing, said high temperature tubing connection comprising a compression fitting.

20 4. The high temperature gas flow sensing element as described in Claim 1, wherein said total pressure sensing Pitot tube array comprises a plurality of individual Pitot tubes arranged such across said interior cross sectional area

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such that traversing patterns formed by the Pitot tubes are placed such that the total number and location of sensing ports are positioned according to formulas recommended by engineering standards organizations.

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5 5. The high temperature gas flow sensing element module as described in Claim 2, wherein said total pressure manifold comprises a generally elongated metal tube, with a first end and a second end in fluid communication with each other, penetrated by an axial series of first manifold input holes penetrating into the center of said elongated metal tube and in fluid communication with each other, each said hole then being tapped such as to receive a standard compression tube fittings, and further comprising a first common receiving hole drilled and tapped in a similar manner along the perpendicular face of said elongated metal tube and, in fluid communication with said holes.

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6. The high temperature gas flow sensing element module as described in Claim 2, wherein instrumentation taps are provided to communicate total and static pressure across the individual gas flow sensing element modules to differential pressure flow indicators and/or transmitting devices.

20 7. A plurality of high temperature gas flow sensing element modules as described in claim 2, arranged in a fashion so as to form a modular gas flow sensing element, said flow sensing element comprising:

a plurality of gas flow sensing element modules that, individually, fit easily through typical furnace access doors;

a plurality of gas flow sensing element modules are arranged adjacent to and aligned in a manner such that said inlets and outlets of said flow sensing element modules lie on the same plane, respectively, and the upper and lower edges of said inlets and outlets lie along the same line, respectively;

a plurality of gas flow sensing element modules are arranged adjacent to and aligned with one another and sealed in a manner so as to create minimal pressure loss; and

a plurality of gas flow sensing element modules are arranged adjacent to and aligned in a manner such that the inside dimensions of the entire arrangement coincide with the internal dimensions of the plenum or duct opening into which it is inserted.

8. Pressure averaging piping used to provide average total and static pressure across the entire gas flow sensing element to differential pressure flow indicators and/or transmitting devices, said pressure averaging piping comprising:

instrumentation piping used to connect said total pressure manifolds and said static pressure Pitot tubes on said gas flow sensing element modules;

instrumentation piping that mechanically averages the total and static pressure across said gas flow sensing element; and

instrumentation taps that provide said averaged total and static pressures to a differential pressure flow indicators and/or transmitting devices.

9. Gas flow sensing element module isolation piping used to provide flow indication across an individual flow element module or totalized flow indication across the entire flow element to differential pressure flow indicators and/or transmitting devices, said isolation piping comprising:

instrumentation piping used to connect said total pressure manifolds and said static pressure Pitot tubes on said gas flow sensing element modules;

instrumentation piping that mechanically averages the total and static pressure across said gas flow sensing element;

instrumentation taps that provide said averaged total and static pressures to a differential pressure flow indicators and/or transmitting devices; and

isolation valves used to isolate a single gas flow sensing element module from said pressure averaging piping, thus providing modular total and static pressures to a differential pressure flow indicators and/or transmitting devices.

10. The high temperature gas flow sensing element module as described in Claim 2, wherein said a total pressure sensing Pitot tube array further comprises a three-way valve connecting each said second end of said Pitot tube to said total pressure manifold, said three-way valve allowing for the redirection of said Pitot tube from said total pressure manifold to a testing port for in-situ calibration

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